

**1. Project Title:**

**Integrated Access to Pacific Region Data Assimilation Model Outputs**

**2. Principal Investigator (PI):**

Title: Computer Scientist

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**3. Other Investigators:**

Name: James Potemra

Organization: University of Hawaii, IPRC/APDRC

Name: Eric Chassignet

Organization: University of Miami, RSMAS

**4. Theme: (Please select One)**

Marine and Coastal Ecosystems

**5. One year PRIDE funding request (\$ K): \$116K**

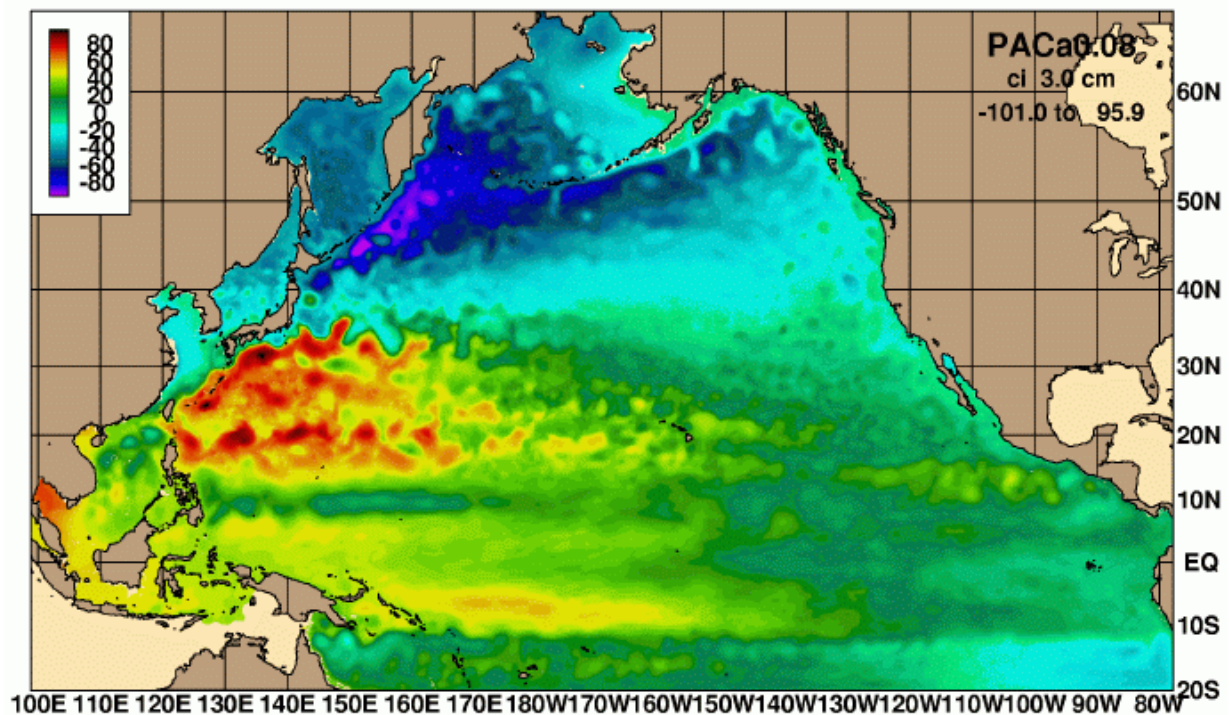
**6. Leveraged Resources: (If applicable)**

This project leverages pre-existing and highly productive relationships between PMEL/TMAP, the APDRC, the HYCOM consortium and others. The APDRC and the PMEL/TMAP group have been working closely together since 1999 to provide access to data in support of researchers and other end users. That connection has facilitated the integration of significant datasets from the National Virtual Ocean Data System (NVOADS – NOPP funded 1999-2002) and the US GODAE Server (ONR funded 1999-present) into the ADPRC. These data, which represent major collections of model outputs and synoptic observations of interest to users in the Pacific Islands, are made available through a Live Access Server (LAS) operated at the ADPRC. Yinghshuo Shen at the APDRC is responsible for maintenance of this LAS and has long been a close collaborator with PMEL's software development team – testing beta releases, and participating in LAS review and planning discussions. The US GODAE server at Monterey is a premier site for access to real time oceanographic measurements received through the GTS and the Argo program.

Phil Sharfstein, the data manager at the US GODAE Server, is also a close collaborator with PMEL/TMAP and makes this data available through his LAS server. The PMEL/TMAP group is a member of the HYCOM modeling consortium, under PI Eric Chassignet of the University of Miami, RSMAS, which is developing and running a state of the art, operational, data assimilation model for the Pacific Ocean basin. A close collaboration of many years duration also exists with the National Marine Fisheries Service (NMFS) data managers (Roy Mendelssohn and Lynn Dewitt) at NOAA's Pacific Fisheries Environmental Laboratory (PFEL). These pre-existing relationships ensure that the process of collaboration will go smoothly and that the resources of this proposal will be applied efficiently to the problems identified.

## **7. Project Objective:**

This project will integrate the current state-of-the-art data assimilation model outputs for the Pacific Islands regions together with real-time and historical observations served from many distributed sources and provide access to them through a simple Web browser interface for Pacific Island end-users and researchers.



**Typical 1/12 degree HYCOM Pacific basin output**

## 8. Project Description:

This project will assemble the current state-of-the-art data assimilation model outputs for the Pacific Islands regions and make them available through a user-friendly Web browser interface that is accessible to all. The model outputs will be presented in a manner that permits users readily to intercompare them and also to compare them with real-time and historical observations served from many distributed sources.

Data assimilation through modeling represents the best form of real-time data integration known today. It is the “Holy Grail” for ocean data product generation. Yet it is also widely understood that improved modeling skill must be achieved. Bringing real-time, operational model outputs for the Pacific Islands region together in a single, integrated interface will permit users to intercompare and assess their relative merits over time. The collection of model outputs will include at a minimum:

1. **HYCOM:** the HYbrid Coordinate Ocean Model 1/12 degree Pacific Ocean operational model runs (provided through collaboration with HYCOM PI, Eric Chassignet);
2. **NLOM:** NAVOCEANO’s 1/16 degree Naval Research Lab (NRL) Layered Ocean Model outputs for the Pacific Island region (provided by Harley Hurlburt at the NAVOCEANO public server);
3. **GODAS:** the newly emerging Global Ocean Data Assimilation System operational outputs from NCEP (at relatively coarse resolution); and
4. **ADPRC models:** downscaling model outputs for HYCOM around Pacific island groups – currently under development at the ADPRC. As these models develop (not available in FY05) biogeochemical variables will be included. ADPRC will also be working with the NOAA Honolulu fisheries lab to make integrated products that blend HYCOM and NLOM outputs with fisheries-useful information.

The HYCOM model will be a particular focus of this proposal. The HYCOM effort is centered on the development of an eddy-resolving, real-time global and basin-scale ocean prediction system (see figure). HYCOM is designed as a generalized (hybrid isopycnal/ $\sigma_z$ ) coordinate ocean model (Bleck, 2002; Chassignet et al., 2003; Halliwell, 2004). It is isopycnal in the open stratified ocean, but reverts to a terrain-following coordinate in shallow coastal regions, and to z-level coordinates near the surface in the mixed layer. This generalized vertical coordinate approach permits a basin scale model to provide much more realistic results close to land boundaries.

Observations and historical data to complement the model outputs will be gleaned Internet-wide. Selected datasets will be hosted locally at the ADPRC, while others will be provided through remote data access via the OPeNDAP protocol. Major providers of remote data will include the US GODAE Server, the

NMFS Pacific Fisheries Environmental Laboratory (PFEL) and the distributed holdings of the National Virtual Ocean Data System (NVODS). Some specific datasets to be highlighted include:

- Real-time and recent past sea surface observations from the GTS;
- Real-time and recent past ocean profile observations from the GTS with a special focus on Pacific Argo profiles;
- The complete historical collection of Pacific Ocean profiles from the World Ocean Data Base;
- Global High Resolution real-time SST (GHRSSST-PP) blended satellite products;
- Monthly, daily and hourly sea level time series from the University of Hawaii Sea Level Center;
- Gridded analysis of *in-situ* observations: COADS, World Ocean Atlas and others;
- Historical fish catch data from NMFS;
- Data from the Tagging Of Pacific Pelagics (TOPP), which uses animal, mounted sensors; and
- Observation collections from WOCE, JGOFS and HOTS.

International Pacific Research Center (IPRC) at the University of Hawaii has been developing the Asia-Pacific Data-Research Center (APDRC) since 2001 with support from NASA, NOAA, JAMSTEC and NASDA. Central elements of the APDRC activities are Data Server System (DSS) operation and continuing development (with PMEL), data and product archiving and management, and value-added product development. The APDRC currently serves a broad range of climate and near real-time products including atmospheric, oceanic, satellite, and air-sea flux with links to remote product sites.

The Live Access Server (LAS) and the OPeNDAP protocol will provide the foundation for web access to the data resources just described. LAS has been in development at PMEL/TMAP for over a decade. In that time it has grown continually both in popularity and in functionality. LAS has been designated as a pre-operational component for data browse in the Data Management And Communications (DMAC) plan for the US Integrated Ocean Observing System (IOOS). The success of LAS relies in large part on the flexibility it offers to data providers in addressing heterogeneous data types and the diverse classes of users encountered in marine science. LAS is designed on the principle that the users' access to data should not require a specialist's knowledge of the data.

PMEL/TMAP will be responsible for LAS development and much of the configuration, while APDRC will be responsible for operational data management. This parallels the relationship that currently exists between the two groups. LAS and OPeNDAP will provide users both with useful information products to support decision making and with "raw" data access to support research. Information products from LAS will include user-specified, on-the-fly visualizations (maps, section contour plots, time series plots, ...), user-specified

tables of numerical values, and downloadable custom subsets of data in a choice of file formats. Users will be able to compare model fields as side-by-side plots, overlays, and difference fields (with automated regridding.) Outputs from models such as HYCOM present significant, new data management challenges because of their complex coordinate systems (curvilinear lat-long and hybrid vertical). LAS enhancements must be incorporated that will hide these complexities from most end users, while exposing them on demand to researchers. New LAS visualization products will be created that combine input from multiple data sources to create true 'ecosystem data products'. Although the underlying datasets are large, the LAS server allows users to make surgical selections of the (vastly smaller) precise data of interest, so the data and information may readily be accessed by low speed (dial-up) connections. This is essential in order to reach many of the potential end-users in the Pacific Islands.

The probability of success for this project is known to be very high because the components have already been demonstrated in current, operational servers. The end result will be an integrated, thematic data server focused on data relevant to the Hawaiian Islands and American Flag Territories in the Pacific. This compilation of varied data resources into a regionally focused server, combined with the easy access to useful data products through LAS, represents a significant step towards the creation of a Pacific Islands Ocean Information System (POIS) as envisioned in previous Pacific Ocean data management workshops.

## **9. Project Deliverables:**

A data and information web site with a regional focus on the Hawaiian Islands and American Flag Territories based upon the Live Access Server. The web site will provide integrated access to state of the art data assimilation model outputs and related observations in support of both decision makers and researchers.

## 10. Budget Breakout:

Funding in WHOLE THOUSANDS of dollars (\$K) only for FY2005:

<b>Total Budget (PMEL plus RSMAS):</b>	(\$ x 1K)
<b>Staffing:</b> (including overheads)	<b>\$65K</b>
<b>Travel:</b> (4 person-trips)	<b>\$6K</b>
<b>Contracts:</b>	<b>\$42K</b>
<b>Equipment:</b>	
<b>Overhead:</b>	<b>\$3K</b>
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<b>TOTAL:</b>	<b>\$116K</b>

<b>PMEL budget:</b>	(\$ x 1K)
<b>Staffing:</b> (including overheads)	
0.5 months PI, Steve Hankin	<b>\$10K</b>
4 months – JISAO (software development)	<b>\$34K</b>
<b>Travel:</b> (2 data management technical meetings)	<b>\$3K</b>
<b>Contracts:</b>	
4 months data and product configuration	<b>\$42K</b>
<b>Equipment:</b>	
<b>Overhead:</b> (PMEL computing charges)	<b>\$3K</b>
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<b>TOTAL:</b>	<b>\$92K</b>

<b>ADPRC budget:</b>	(\$ x 1K)
(Significant in-kind contributions)	<b>NO CHARGE</b>

<b>RSMAS (HYCOM) budget:</b>	(\$ x 1K)
<b>Staffing:</b> (including overheads)	
0.25 months PI, Eric Chassignet	<b>N/C</b>
2 months. A Srinivasan (sysadmin)	<b>\$21K</b>
<b>Travel:</b> (2 data management technical meetings)	<b>\$3K</b>
<b>Contracts:</b>	
<b>Equipment:</b>	
<b>Overhead:</b>	
<b>TOTAL:</b>	----- <b>\$24K</b>